

# nta

**Question Paper Name :** B TECH 26th Feb 2021 Shift 2  
**Subject Name :** B TECH  
**Creation Date :** 2021-02-25 13:49:48  
**Duration :** 180  
**Number of Questions :** 90  
**Total Marks :** 300  
**Display Marks:** Yes

## B TECH

**Group Number :** 1  
**Group Id :** 708191228  
**Group Maximum Duration :** 0  
**Group Minimum Duration :** 180  
**Show Attended Group? :** No  
**Edit Attended Group? :** No  
**Break time :** 0  
**Group Marks :** 300  
**Is this Group for Examiner? :** No

## Physics Section A

**Section Id :** 708191946  
**Section Number :** 1  
**Section type :** Online

<b>Mandatory or Optional :</b>	Mandatory
<b>Number of Questions :</b>	20
<b>Number of Questions to be attempted :</b>	20
<b>Section Marks :</b>	80
<b>Mark As Answered Required? :</b>	Yes
<b>Sub-Section Number :</b>	1
<b>Sub-Section Id :</b>	7081911226
<b>Question Shuffling Allowed :</b>	Yes

**Question Number : 1 Question Id : 70819121094 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A radioactive sample is undergoing  $\alpha$  decay. At any time  $t_1$ , its activity is A and another time  $t_2$ , the activity is  $\frac{A}{5}$ . What is the average life time for the sample ?

**Options :**

70819168431.  $\frac{\ln 5}{t_2 - t_1}$

70819168432.  $\frac{\ln(t_2 + t_1)}{2}$

70819168433.  $\frac{t_2 - t_1}{\ln 5}$

70819168434.  $\frac{t_1 - t_2}{\ln 5}$

**Question Number : 2 Question Id : 70819121095 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Given below are two statements : one is labeled as Assertion A and the other is labeled as Reason R.

Assertion A : For a simple microscope, the angular size of the object equals the angular size of the image.

Reason R : Magnification is achieved as the small object can be kept much closer to the eye than 25 cm and hence it subtends a large angle.

In the light of the above statements, choose the most appropriate answer from the options given below :

**Options :**

70819168435. Both A and R are true and R is the correct explanation of A

70819168436. Both A and R are true but R is NOT the correct explanation of A

70819168437. A is true but R is false

70819168438. A is false but R is true

**Question Number : 3 Question Id : 70819121096 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A tuning fork A of unknown frequency produces 5 beats/s with a fork of known frequency 340 Hz. When fork A is filed, the beat frequency decreases to 2 beats/s. What is the frequency of fork A ?

**Options :**

70819168439. 335 Hz

70819168440. 338 Hz

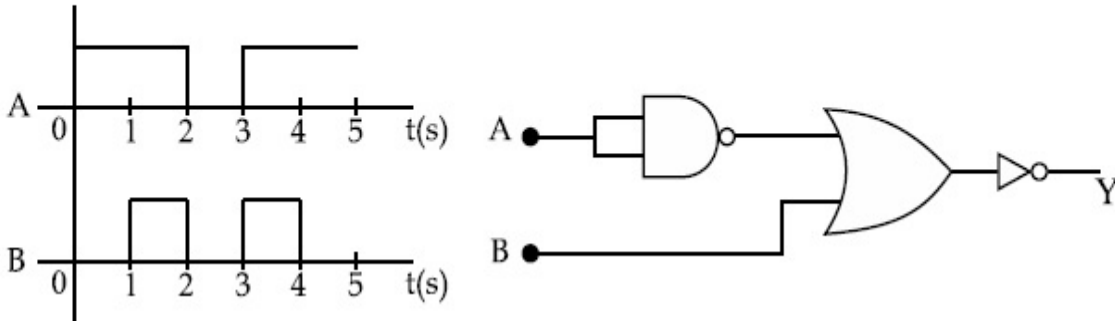
70819168441. 345 Hz

70819168442. 342 Hz

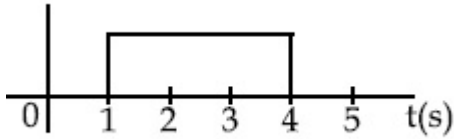
Question Number : 4 Question Id : 70819121097 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

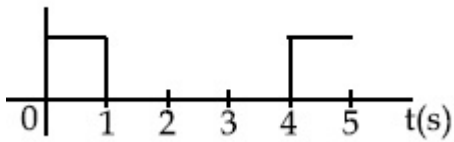
Draw the output signal Y in the given combination of gates.



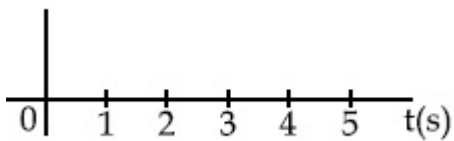
Options :



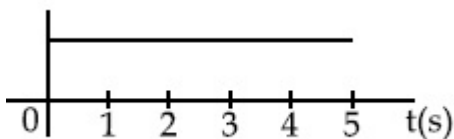
70819168443.



70819168444.



70819168445.



70819168446.

Question Number : 5 Question Id : 70819121098 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

**Correct Marks : 4 Wrong Marks : 1**

Given below are two statements :

Statement I : A second's pendulum has a time period of 1 second.

Statement II : It takes precisely one second to move between the two extreme positions.

In the light of the above statements, choose the correct answer from the options given below :

**Options :**

70819168447. Both Statement I and Statement II are true

70819168448. Both Statement I and Statement II are false

70819168449. Statement I is true but Statement II is false

70819168450. Statement I is false but Statement II is true

**Question Number : 6 Question Id : 70819121099 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

If 'C' and 'V' represent capacity and voltage respectively then what are the dimensions of  $\lambda$  where  $C/V = \lambda$  ?

**Options :**

70819168451.  $[M^{-2} L^{-3} I^2 T^6]$

70819168452.  $[M^{-3} L^{-4} I^3 T^7]$

70819168453.  $[M^{-2} L^{-4} I^3 T^7]$

70819168454.  $[M^{-1} L^{-3} I^{-2} T^{-7}]$

**Question Number : 7 Question Id : 70819121100 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

An aeroplane, with its wings spread 10 m, is flying at a speed of 180 km/h in a horizontal direction. The total intensity of earth's field at that part is  $2.5 \times 10^{-4}$  Wb/m<sup>2</sup> and the angle of dip is 60°. The emf induced between the tips of the plane wings will be \_\_\_\_\_.

**Options :**

70819168455. 108.25 mV

70819168456. 62.50 mV

70819168457. 88.37 mV

70819168458. 54.125 mV

**Question Number : 8 Question Id : 70819121101 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A cord is wound round the circumference of wheel of radius r. The axis of the wheel is horizontal and the moment of inertia about it is I. A weight mg is attached to the cord at the end. The weight falls from rest. After falling through a distance 'h', the square of angular velocity of wheel will be :

**Options :**

70819168459.  $2gh$

70819168460.  $\frac{2gh}{I + mr^2}$

70819168461.  $\frac{2mgh}{I + mr^2}$

70819168462.  $\frac{2mgh}{I + 2mr^2}$

**Question Number : 9 Question Id : 70819121102 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The trajectory of a projectile in a vertical plane is  $y = \alpha x - \beta x^2$ , where  $\alpha$  and  $\beta$  are constants and  $x$  &  $y$  are respectively the horizontal and vertical distances of the projectile from the point of projection. The angle of projection  $\theta$  and the maximum height attained  $H$  are respectively given by :

**Options :**

70819168463.  $\tan^{-1}\beta, \frac{\alpha^2}{2\beta}$

70819168464.  $\tan^{-1}\left(\frac{\beta}{\alpha}\right), \frac{\alpha^2}{\beta}$

70819168465.  $\tan^{-1}\alpha, \frac{\alpha^2}{4\beta}$

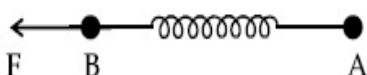
70819168466.  $\tan^{-1}\alpha, \frac{4\alpha^2}{\beta}$

**Question Number : 10 Question Id : 70819121103 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Two masses A and B, each of mass  $M$  are fixed together by a massless spring. A force acts on the mass B as shown in figure. If the mass A starts moving away from mass B with acceleration 'a', then the acceleration of mass B will be :



**Options :**

70819168467.  $\frac{MF}{F + Ma}$

70819168468.  $\frac{F + Ma}{M}$

70819168469.  $\frac{Ma - F}{M}$

70819168470.  $\frac{F - Ma}{M}$

**Question Number : 11 Question Id : 70819121104 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Given below are two statements :

**Statement I** : An electric dipole is placed at the centre of a hollow sphere. The flux of electric field through the sphere is zero but the electric field is not zero anywhere in the sphere.

**Statement II** : If R is the radius of a solid metallic sphere and Q be the total charge on it. The electric field at any point on the spherical surface of radius r (< R) is zero but the electric flux passing through this closed spherical surface of radius r is not zero.

In the light of the above statements, choose the correct answer from the options given below :

**Options :**

70819168471. Both Statement I and Statement II are true

70819168472. Both Statement I and Statement II are false

70819168473. Statement I is true but Statement II is false



70819168474. Statement I is false but Statement II is true

**Question Number : 12 Question Id : 70819121105 Question Type : MCQ Option Shuffling : Yes  
Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A scooter accelerates from rest for time  $t_1$  at constant rate  $a_1$  and then retards at constant rate  $a_2$  for time  $t_2$  and comes to rest. The correct value of  $\frac{t_1}{t_2}$  will be :

**Options :**

70819168475.  $\frac{a_1}{a_2}$

70819168476.  $\frac{a_2}{a_1}$

70819168477.  $\frac{a_1 + a_2}{a_1}$

70819168478.  $\frac{a_1 + a_2}{a_2}$

**Question Number : 13 Question Id : 70819121106 Question Type : MCQ Option Shuffling : Yes  
Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The internal energy (U), pressure (P) and volume (V) of an ideal gas are related as  $U = 3PV + 4$ .  
The gas is :

**Options :**

70819168479. monoatomic only.

70819168480. diatomic only.

70819168481. polyatomic only.

70819168482. either monoatomic or diatomic.

**Question Number : 14 Question Id : 70819121107 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The recoil speed of a hydrogen atom after it emits a photon in going from  $n=5$  state to  $n=1$  state will be :

**Options :**

70819168483. 4.34 m/s

70819168484. 4.17 m/s

70819168485. 3.25 m/s

70819168486. 2.19 m/s

**Question Number : 15 Question Id : 70819121108 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The length of metallic wire is  $l_1$  when tension in it is  $T_1$ . It is  $l_2$  when the tension is  $T_2$ . The original length of the wire will be :

**Options :**

70819168487.  $\frac{l_1 + l_2}{2}$

70819168488.  $\frac{T_2 l_1 + T_1 l_2}{T_1 + T_2}$

70819168489.  $\frac{T_1 l_1 - T_2 l_2}{T_2 - T_1}$

70819168490.  $\frac{T_2 l_1 - T_1 l_2}{T_2 - T_1}$

**Question Number : 16 Question Id : 70819121109 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A particle executes S.H.M., the graph of velocity as a function of displacement is :

**Options :**

70819168491. a circle.

70819168492. a parabola.

70819168493. an ellipse.

70819168494. a helix.

**Question Number : 17 Question Id : 70819121110 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The incident ray, reflected ray and the outward drawn normal are denoted by the unit vectors  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  respectively. Then choose the correct relation for these vectors.

**Options :**

70819168495.  $\vec{b} = \vec{a} - \vec{c}$

70819168496.  $\vec{b} = \vec{a} - 2(\vec{a} \cdot \vec{c})\vec{c}$

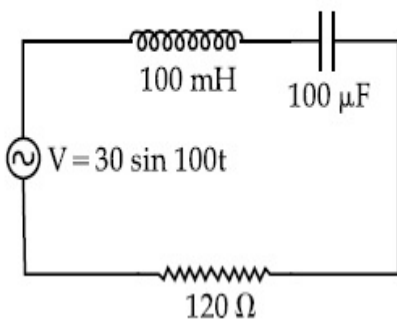
70819168497.  $\vec{b} = \vec{a} + 2\vec{c}$

70819168498.  $\vec{b} = 2\vec{a} + \vec{c}$

**Question Number : 18 Question Id : 70819121111 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Find the peak current and resonant frequency of the following circuit (as shown in figure).



**Options :**

70819168499. 2 A and 50 Hz

70819168500. 0.2 A and 50 Hz

70819168501. 2 A and 100 Hz

70819168502. 0.2 A and 100 Hz

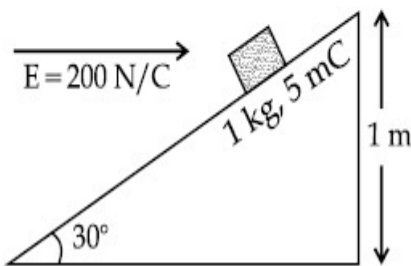
**Question Number : 19 Question Id : 70819121112 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

An inclined plane making an angle of  $30^\circ$  with the horizontal is placed in a uniform horizontal electric field  $200 \frac{\text{N}}{\text{C}}$  as shown in the figure. A body of mass 1 kg and charge 5 mC is allowed to slide down from rest at a height of 1 m. If the coefficient of friction is 0.2, find the time taken by the body to reach the bottom.

$$[g = 9.8 \text{ m/s}^2; \sin 30^\circ = \frac{1}{2}; \cos 30^\circ = \frac{\sqrt{3}}{2}]$$



**Options :**

70819168503. 2.3 s

70819168504. 1.3 s

70819168505. 0.92 s

70819168506. 0.46 s

**Question Number : 20 Question Id : 70819121113 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A wire of  $1 \Omega$  has a length of 1 m. It is stretched till its length increases by 25%. The percentage change in resistance to the nearest integer is :

**Options :**

70819168507. 76%

70819168508. 56%

70819168509. 25%

70819168510. 12.5%

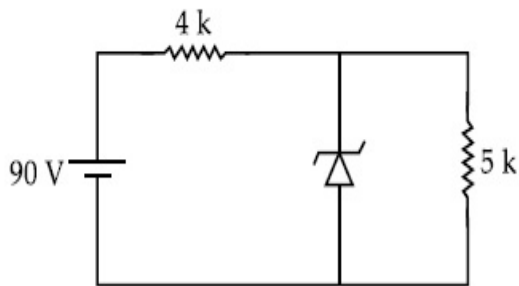
## Physics Section B

<b>Section Id :</b>	708191947
<b>Section Number :</b>	2
<b>Section type :</b>	Online
<b>Mandatory or Optional :</b>	Mandatory
<b>Number of Questions :</b>	10
<b>Number of Questions to be attempted :</b>	5
<b>Section Marks :</b>	20
<b>Mark As Answered Required? :</b>	Yes
<b>Sub-Section Number :</b>	1
<b>Sub-Section Id :</b>	7081911227
<b>Question Shuffling Allowed :</b>	Yes

**Question Number : 21 Question Id : 70819121114 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

The zener diode has a  $V_z = 30$  V. The current passing through the diode for the following circuit is \_\_\_\_\_ mA.



**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

**Possible Answers :**

5 to 5.001

**Question Number :** 22 **Question Id :** 70819121115 **Question Type :** SA

**Correct Marks :** 4 **Wrong Marks :** 0

Time period of a simple pendulum is  $T$ . The time taken to complete  $\frac{5}{8}$  oscillations starting

from mean position is  $\frac{\alpha}{\beta}T$ . The value of  $\alpha$  is \_\_\_\_\_ .

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

**Possible Answers :**

5 to 5.001

**Question Number :** 23 **Question Id :** 70819121116 **Question Type :** SA

**Correct Marks :** 4 **Wrong Marks :** 0

The volume  $V$  of a given mass of monoatomic gas changes with temperature  $T$  according to

the relation  $V = KT^{\frac{2}{3}}$ . The workdone when temperature changes by 90 K will be  $xR$ . The value of  $x$  is \_\_\_\_\_.

[ $R$  = universal gas constant]

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

**Possible Answers :**

5 to 5.001

**Question Number :** 24 **Question Id :** 70819121117 **Question Type :** SA

**Correct Marks :** 4 **Wrong Marks :** 0

Two stream of photons, possessing energies equal to twice and ten times the work function of metal are incident on the metal surface successively. The value of ratio of maximum velocities of the photoelectrons emitted in the two respective cases is  $x : y$ . The value of  $x$  is \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

**Possible Answers :**

5 to 5.001

**Question Number :** 25 **Question Id :** 70819121118 **Question Type :** SA

**Correct Marks :** 4 **Wrong Marks :** 0

If the highest frequency modulating a carrier is 5 kHz, then the number of AM broadcast stations accommodated in a 90 kHz bandwidth are \_\_\_\_\_.

**Response Type :** Numeric



**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

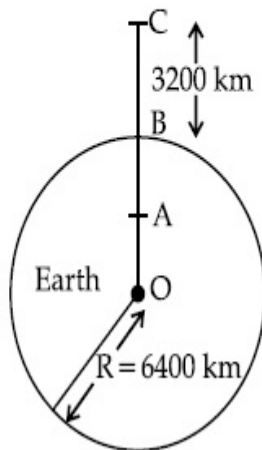
**Possible Answers :**

5 to 5.001

**Question Number :** 26 **Question Id :** 70819121119 **Question Type :** SA

**Correct Marks :** 4 **Wrong Marks :** 0

In the reported figure of earth, the value of acceleration due to gravity is same at point A and C but it is smaller than that of its value at point B (surface of the earth). The value of OA : AB will be  $x : y$ . The value of  $x$  is \_\_\_\_\_.



**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

**Possible Answers :**

5 to 5.001

**Question Number :** 27 **Question Id :** 70819121120 **Question Type :** SA

**Correct Marks :** 4 **Wrong Marks :** 0

1 mole of rigid diatomic gas performs a work of  $\frac{Q}{5}$  when heat  $Q$  is supplied to it. The molar heat capacity of the gas during this transformation is  $\frac{xR}{8}$ . The value of  $x$  is \_\_\_\_\_.

[ $R$  = universal gas constant]

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

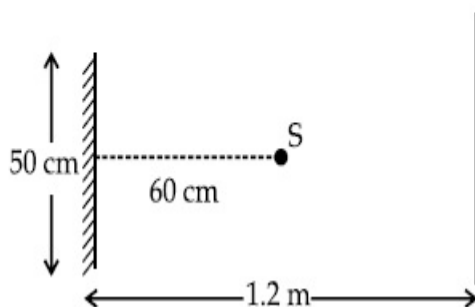
**Possible Answers :**

5 to 5.001

**Question Number :** 28 **Question Id :** 70819121121 **Question Type :** SA

**Correct Marks :** 4 **Wrong Marks :** 0

A point source of light  $S$ , placed at a distance 60 cm in front of the centre of a plane mirror of width 50 cm, hangs vertically on a wall. A man walks in front of the mirror along a line parallel to the mirror at a distance 1.2 m from it (see in the figure). The distance between the extreme points where he can see the image of the light source in the mirror is \_\_\_\_\_ cm.



**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

**Possible Answers :**

5 to 5.001

**Question Number : 29 Question Id : 70819121122 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

A particle executes S.H.M. with amplitude 'a' and time period 'T'. The displacement of the particle when its speed is half of maximum speed is  $\frac{\sqrt{x}a}{2}$ . The value of x is \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

**Possible Answers :**

5 to 5.001

**Question Number : 30 Question Id : 70819121123 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

27 similar drops of mercury are maintained at 10 V each. All these spherical drops combine into a single big drop. The potential energy of the bigger drop is \_\_\_\_\_ times that of a smaller drop.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Range

**Text Areas :** PlainText

**Possible Answers :**

5 to 5.001